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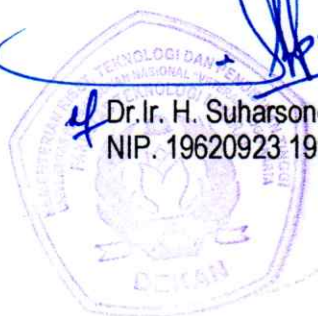
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# PROCEEDINGS

# Regional Geoheritage Conference 2016

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# Proceedings

## Regional Geoheritage Conference 2016

The 9<sup>th</sup> Indonesia-Malaysia Conference

“Exotic Past for our Future”



Seminar Held on 24 November 2016  
In Hotel Hyatt Regency Yogyakarta, Indonesia

Field Trip Held on 25 November 2016



# Proceedings

## Regional Geoheritage Conference 2016

### The 9<sup>th</sup> Indonesia-Malaysia Conference

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# PROPOSED REPACKING – BOYOLALI GEOHERITAGE

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## ABSTRACT

Geological phenomena complete for learning for future generation (new geologist) in nature is very hard to find. Moreover, Indonesia is a tropical country with very high rainfall resulting in erosion and weathering are very intensive. In the area of District Repaking, Wonosegoro, Boyolali Central Java, Indonesia with coordinates (07012'34"SL, 110037'55"EL), (07012'34"SL, 110040'43"EL), (07016'22"SL, 110037'55"EL), (07016'22"SL, 110040'43"EL), Geological phenomena have a very full interesting and still relatively intact and very good for learning for prospective geologist (new geologist). Phenomena in the form of sediment structure, whereas flute casts, humocky, sand dike, slump bedding, mega slump, lamination, bedding, convolute, cross bedding, graded bedding, flysch, mega block, burrow, Load cast. Geological structure, such as Left Reverse Slip Fault, Reverse Slip Fault, Reverse Left Slip Fault, Left slip Fault, Fold. Geological manifestations, can be found Oil seepage (2 points), carbon gas (8 points), Waterfalls (9 locations) with a height between 3m – 18.5 m, and Cave. In addition to the above phenomenon, the existence of the source rock or origin of oil and gas seepage is still widely discussed and debated by many experts, as yet unresolved. Aside from being a laboratory of geology, this area is proposed as well as regional geology-based Tourism.

## Background

Importance as a natural laboratory for the urgent needs of geologists, as well as geological sights is based is in need

Geological phenomena in nature that complete and ideal for learning for future generations (new geologist) has been very hard to find, especially Indonesian is a tropical country with a very high rainfall resulting in erosion and weathering is very intense.

## Purpose and Objectives

The purpose of this study is to provide information about the phenomenon - the geological phenomenon that is ideal for learning the Wonosegoro district, Boyolali regency and Kedungjati district, Grobogan regency, Central Java Province, Indonesia, was destination of this study for potential addition to learning geologist (New Geologist) can also be used as a tourist attraction based on geology.

## Regional locations and accomplished

Location of administrative, the study sites included in the Wonosegoro district, Boyolali regency and Kedungjati district, Grobogan regency, Central Java Province. ± 40 Km<sup>2</sup> area, with coordinates 07° 12' 34" - 07° 16' 22" SL and 110° 37' 55" - 110° 40' 43" EL.

Location of Yogyakarta can be reached by following the route from Yogyakarta to Boyolali taken using a landline to a distance of  $\pm 80$  km, taken for  $\pm 2$  hours, and from the city to the location in the District Boyolali - Wonosegoro a distance of  $\pm 24$  km, taken for  $\pm 1$  hour

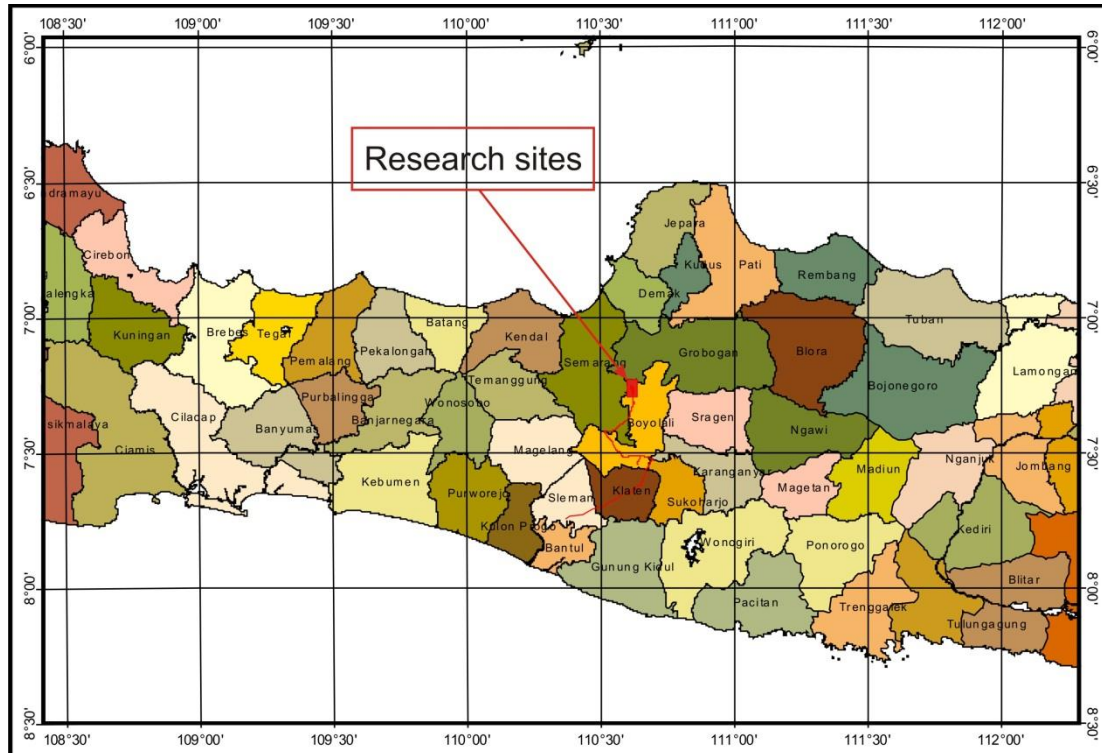


Figure 1. Regional Location Map and Accomplished



## Tectonic

The first deformation occurs in Kendeng zone at the end of the Pliocene (Plio - Plistosen), the deformation zone is a manifestation of tectonic plates converge on the concept of compression forces caused by the relative trending north - south with a ductile type of formation is the final phase of brittle deformation turns into a shifting block - basic block Kendeng basin zone. The greater the intensity of the compression force to the western part of Zone Kendeng which caused a lot of folds and faults found up where a lot of reverse fault zone is also the contact between formations or formation members.

Deformation Plio - Plistosen can be divided into three phases, namely the first phase resulting in the formation of folding Geantiklin Kendeng with the general direction west - east and lead in the Eastern Kendeng, the second phase of faulting which can be divided into two, namely faulting due folding and faulting has changed due to deformation of brittle ductile deformation because the rocks have been beyond the depth of plastic. Both of these faults is generally a reverse fault and some have a recumbent fault section.

The third phase of a shift in the basic blocks Kendeng basin zone which resulted in a fault - fault trending shear relatively north - south.

The second deformation occurred during the last quarter of a slow and resulted in the formation of structure in the Sangiran dome. This deformation has continued until today with the relatively small intensity with evidence of the formation of the youngest sediments in Kendeng zone the deposition steps.

general, the structure - a structure that is in Kendeng zone form:

### A. Fold

That there are fold in the folds Kendeng mostly there are even some asymmetry in the form of overturned folds. the folds in this area there that has a pattern enechelon fold and there is a folds menunjam. In general trending folds in the Kendeng area west - east.

### B. Reverse fault

Reverse fault is common in folds that are often found in Kendeng zone, and usually the contact between formations or formation members.

### C. Slip Fault

Fault shear zone Kendeng usually air on the northeast-southwest and southeast-northwest.

### D. The dome structure

The dome structure that is in Kendeng zone usually found in the Sangiran area lithologies Quaternary age. The evidence shows that the dome structure in this area generated by the second deformation, namely in Plistosen epoch.

## Stratigraphy

Most of the sediments are exposed in Kendeng zone in Neogen or Quaternary age. Sediments is often different facies from west to east and from south to north. Stratigraphic Kendeng zones began when sediments were deposited in depressions Kendeng erosional products derived from a series of sedimentation that occurred in Northeast Java Basin to the south.

Kendeng stratigraphic zones can be divided into 3 (three) big primary Sequence, that is;

1. Eocene - Early Oligocene Sequence;
2. Late Oligocene Miocene Sequence;
3. Plio - Plistosen Sequence.

Sequence Eocene - Early Oligocene associated with the initial expansion of the East Java Basin. Late Oligocene section - the underlying Miocene Sequence distinguished by a regional unconformity. Sikuen Plio - Plistosen is not aligned on Sequence Late Oligocene - Miocene.

De Genevraye and Luki Samuel in his GEOLOGY OF THE KENDENG ZONE (CENTRAL & EAST JAVA), 1972 Kendeng share more detailed stratigraphic zones into three parts, namely Kendeng West, Central and Eastern. Refers to this area of research is on the western Kendeng Zone (Figure 2) with the stratigraphic formations from oldest to youngest are:

#### 1. Pelang Formation

This formation began settling in the strip Kendeng Zone. The characteristics of lithology consists of looping between the marl and marl lempungan with insert bioklastik limestone lenses. Stratigraphic relationship with the older rock units can not be known, because it has not been revealed. Based on the content of planktonic foraminifera are abundant in the marl rock bottom of this formation indicates Zone N4 (Blow, 1969) or Early Miocene age.

By looking at the ratio of planktonic foraminifera fossils bentonik content is relatively high (80%), this is interpreted in sedimentation of Pelang formation on the open ocean environment, away from the beach, that is the bathyal zone to a depth of about 1000 to 2000 meters.

#### 2. Kerek Formation

Pelang Formation was deposited over the kerek Formation is aligned. Lithological characteristics, the the bottom of the loop consists of marl clay, marl and clay with calcareous tufa sandstone and tuff sandstones. The middle section between the rocks compiled by intercalation clay with pyroclastic deposits. The top of this formation occupied by clastic limestones that can reach thicknesses of up to 150 meters

In this formation lies stratigraphically below are not aligned Kalibeng Formation which is characterized by the presence of base conglomerates, known as the interval "a" of the sediment sequence of turbidit kerek formation.

This formation is well developed in the mountains of western and central Kendeng, began Purwodadi to Pandan Mount, even to the east is still exposed (to the north Kertosono), then under the plains of the Brantas River. Thickness of this formation + 1000 meters, Based on planktonic foraminifera, the age of this formation ranges from N 13 - N 16 according to the zoning Blow (1969) or Middle Miocene - Upper Miocene.

With the srukture discovery parallel lamination, konvolut lamination, current srukture interval is interpreted as c, d and e of the sediment sequence of Bouma turbidit are found in almost all layers of this formation, it is clear that the environment of deposition which is a Kerek Formation sediments deposited distal turbidit the a slope basin in upper bathyal environments, with depths between 200-500 meters. From west to east and from south to north, found a change in facies in this formation. Volcanic materials found in this formation is generally coarser grained and more often found in the west, on the contrary to be relatively more smooth and less in the east of Mandala Kendeng. In general, the

deposition of pyroclastic material deposited along the Mandala Kendeng, decreases from south to north. Kerek Formation to the north allegedly changed facies into Wonocolo Formation exposed at Mandala Rembang.

### **3. Kalibeng Formation**

Lithology of the Kalibeng formation consists globigerina marl deposits from the massive, greenish and are clay marl, blue or bluish green contain many planktonic foraminifera. Based on stratigraphic relationships, the location of the type of fault with the formation and kerek formation contact, and deposited aligned under a Sonde Formations. Have a broad spread along the Kendeng Mountains starting from Gundih the west until Mojokerto in the east. The thickness of this formation, ranging from 500-700 meters. Age of this formation is Late Miocene to Lower Pliocene, or Zone N 17 - N 19 of the classification of Blow (1969). The characteristics of this formation is the abundance of planktonic foraminifera content of 70% - 80%.

Which characterizes the deposition environment and in that is open sea in bathyal zone to a depth of between 200-500 meters. Kalibeng Formation is divided into three formations member who has a different relationship with the Kalibeng formation own facies are:

#### **a) Member **Banyak** of Kalibeng Formation**

This member intercalation consists of tuffs sandstone, breccias and volcanic-rich marl tuffaan globigerina, which contain material that is andesite. The thickness of this member is not uniform, ranging from a thickness of 1600 meters - 100 meters. By the age of this member is Late Miocene. Looking at the structure of sedimentary bedding compound intercalation, parallel to bedding, parallel lamination turbidit indicating a precipitate, which was deposited in the marine environment.

Banyak members of the lower part of the Kalibeng Formation the stratigraphic relationships aligned with the older formations, that is kerek formation. whereas the formation Kalibeng own, many members have a different relationship toge facies.

#### **b) **Damar** Members of Kalibeng Formation**

Damar is composed of members of the lithology of conglomerates, pebbles sandstone, calcareous sandstones with mudstone inserts. Where generally the composition of the lithology is andesite. Based on the content of fossils found in these Member of is relative age of the conclusions obtained Moisten end-Pliocene (N17-N20) with the environment of deposition in the form sublitoral (Purnamaningsih, 1982). Another name of this unit is used by Damar Formation Van Bemmelen, 1941 located in Damar river type, Waleri south, east of Central Java. Damar members have different relationships with the Formation intrfingering facies own Kalibeng

#### **c) **Kapung** Members of Kalibeng Formation**

Kapung members are part of the formation lithology Kalibeng who have a solid limestone on the bottom. on the top of the Members Kapung intercalation prepared by the lithology of sandy limestone, bioclastic limestone, coral limestone and marl. Analysis of the data contained in the fossil content of kapung members get it at the age of this unit is the Late Miocene-Early Pliocene (N17-N20) with the deposition of shallow marine environment with activities that coral growth is influenced by volcanic activity. Kapung Formation name used by Van Bemmelen (1941, 1949) located at on Mount Kapung 4 km west of



the Kali Tuntang. This member has a relationship with the Kalibeng formation lenses facies.

4. Notopuro formation

In type Notopuro Formation consists of tuff rock sandstones alternating with tuffs, volcanic breccias and conglomerates. This formation is located above the Kabuh Formation was deposited aligned. This formation is widespread in the Kendeng mountains, the south wing from Salatiga in the west to the east Mojokerto. Its thickness varies, at the Kali Rejuno can reach over 240 meters. In general, a lahar deposits that occur on land. This formation was deposited at the age of late Plistosen.

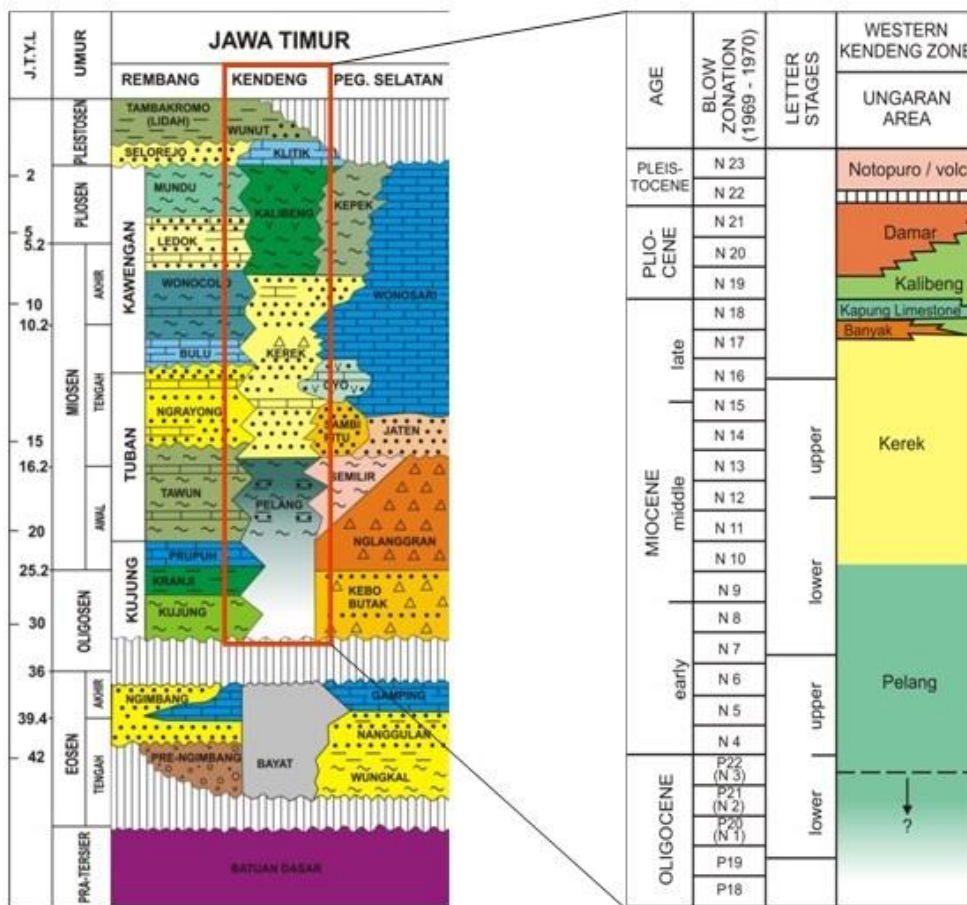


Figure 2. Summary of regional stratigraphy of eastern Java by H. Pringgoprawiro, 1983 (left), the stratigraphic column of the western zone Kendeng by Luki Samuel De Genevraye and 1972 (right), a simple stratigraphy of the Cenozoic Zone Kendeng Smyth et al, 2005

## The potential of Local Geology

### a) Stratigrafi

#### 1) Kerek Formation

Characteristic lithology of this unit of sandstone and mudstone intercalation tightly enough (Flysch), intercalation mudstone, sandstone and calcareous sandstone found in several places tuffan, this unit is dominated by mudstone with a ratio of 3:1. sedimentary structures in the form Humocky, graded bedding, slump, mega slump, ripple mark, parallel lamination, flute cast, clay pellet, convolute lamination, sand dike, wavy lamination, cross lamination, mudstone is gray to greenish, massive, konkoidal, contain carbonate cement, thick 15-70 cm, calcareous sandstone, brown, fine to medium-sized, fine to medium distinct, rounded, is calcareous, composed of calcite, quartz, and tuff, thick, 5-25 cm. In the southern part of the research areas of high volcanic kerek formation elements in the zone above bathymetri bathial center - with flute cast sedimentary structure with the current direction of an ancient relative of the south to north.

While on the northern part of the research areas of volcanic elements decreases and is dominated by shallow marine elements in terms of sedimentary structures characterized by the presence of micro Humocky and abundant fossils. Flute cast on the northern part of the study area trending north-south, as opposed to the flute casts found in the southern area of research.



Figure 3. intercalation between sandstone calcareous mudstone which is dominated by mudstone, kerek Formation, on the Village Bengle, District Wonosegoro, Boyolali Regency - Central Java.

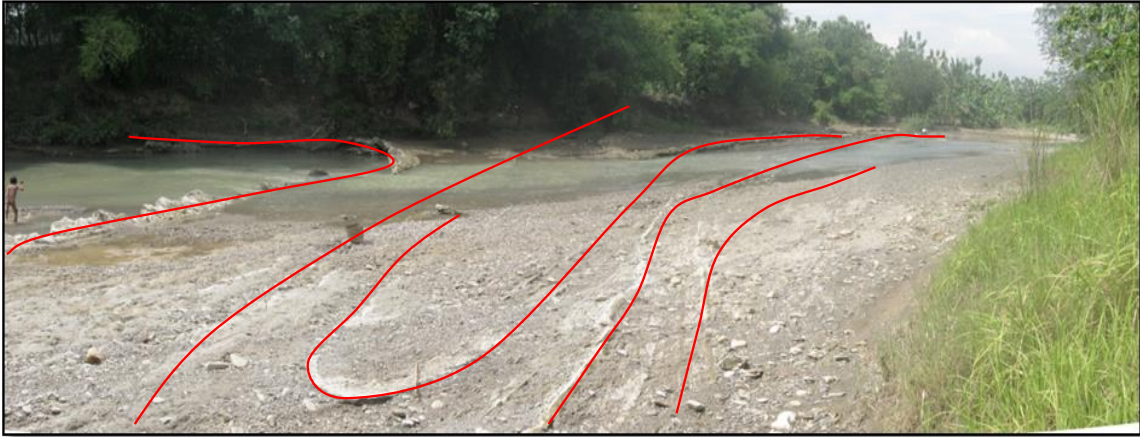


Figure 4. intercalation calcareous sandstones with mudstone between (Flysch) and graded bedding (Ta), parallel to bedding (Tb), convolute lamination, slump bedding (Tc), Parallel lamination (Td), Mega Slump is an indication of sediment turbidit.



Figure 5. The appearance of Sediment Structure in kerek Formation Sand Dike Padasmalang in the Village, District Wonosegoro, Boyolali Regency - Central Java.





fluet cast has an ancient current direction to NE-SW , Kerek formation, the camera to the Southeast



fluet cast has an ancient current direction to N-S , Kerek formation, the camera to the West



fluet cast has an ancient current direction to S-W , Kerek formation, the camera to the Southeast



fluet cast has an ancient current direction to S-W , Kerek formation, the camera to the Southeast

Figure 7. Flute cast and direction of deposition of ancient currents

### 1) Members of the Formation Kalibeng

Lithology units making up this form of alternation between Tufan sandstone, calcareous sandstone and pebble sandstone. Generally well layered, sedimentary structures are frequently encountered form of bedding, parallel lamination, graded bedding, mega block, sometimes found sphaerodal wheatering, with the dominance of sandstones tuffan.

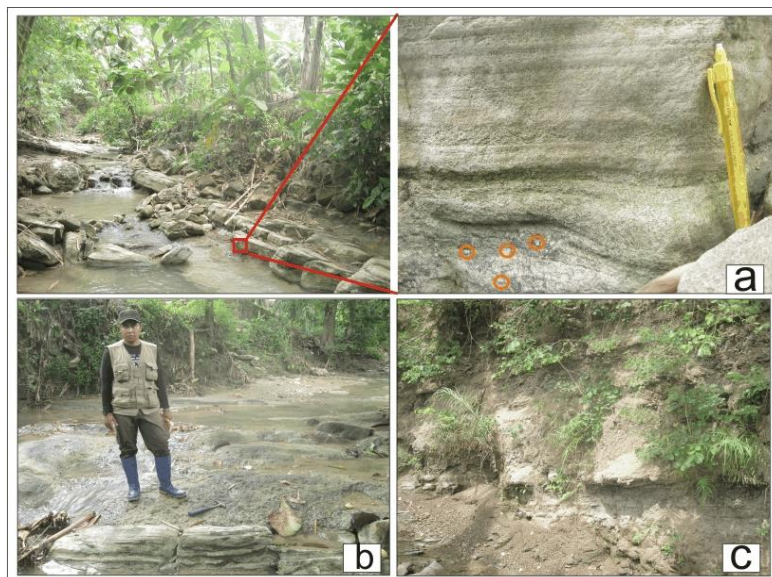




Figure 8. Tuffan sandstones with graded bedding and parallel structure of the laminate (A), calcareous sandstone and pabbles sandstone (B), calcareous siltstone (C).



Figure 9. Mega bloks Structure Banyak Member of the Kalibeng Formation In Grogol village, Grobogan Regency - Central Java.

### a) Geology Structure

#### 1. Jatilawang Fault

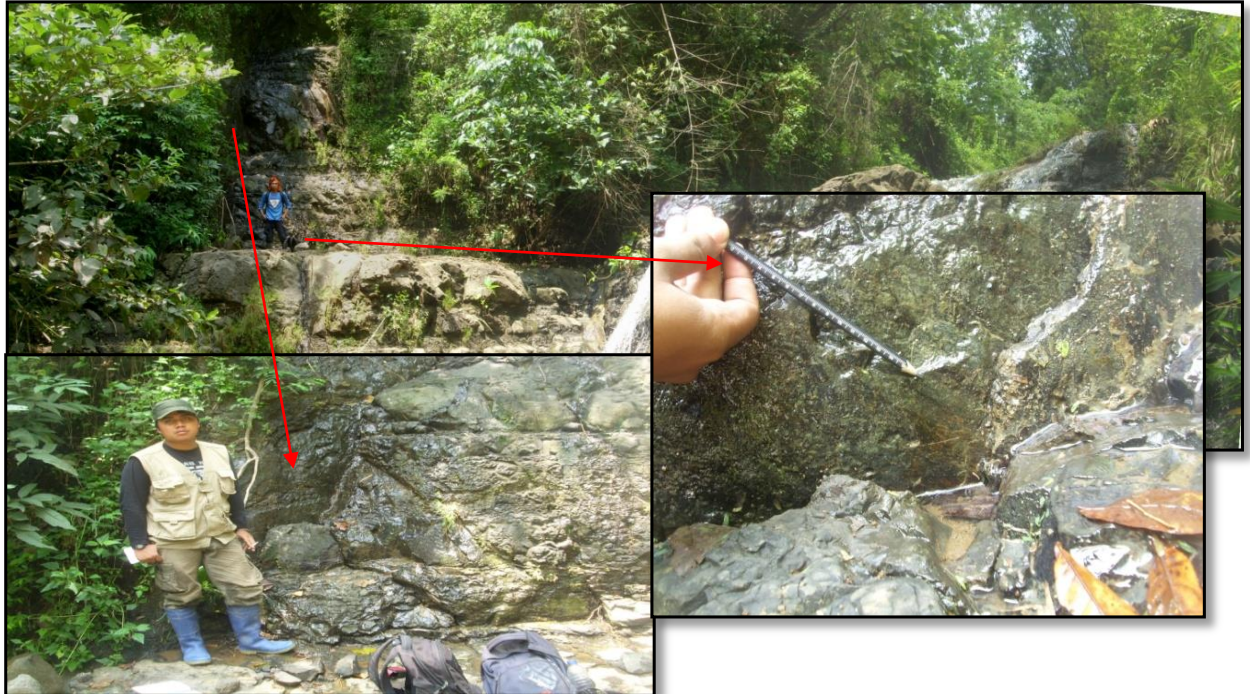


Figure 10. The appearances Jatilawang fault (Left Reverse Slip Fault (Rickard (1972)) in Banyak members of the Kalibeng formation, Jatilawang Village, District Wonosegoro, Boyolali Regency - Central Java



## 2. Garangan Fault



Figure 11. The appearance of vertical layers and fault zone in Garangan fault (Reverse Slip Fault (Rickard (1972))).

## 3. Panimbo Fault



Figure 12. The appearance of Panimbo faults (Reverse Left Slip Fault (Rickard (1972))) in Kerek Formation in the Panimbo Village, Wonosegoro District, Boyolali Regency - Central Java





Figure 13. The appearance Wuluhan Fault (*Thrust left Slip Fault* (Rickard, 1972)) in Kerek Formation in the Wuluhan Village, Wonosegoro District, Boyolali - Central Java



Figure 14. The appearance Ngetuk Fault (*Right Reverse Slip Fault* (Rickard, 1972)) in kerek Formation in the Ngetuk village, Wonosegoro District, Boyolali Regency - Central Java

#### 4. Wuluhan Fold



Figure 15. The appearance of the fold axis (C), wing folds (A, B) from Gandu Fold Upright (*Gentle Plunging Fold* (Fluety, 1964)) Kerek Formation in the Gandu Village, Wonosegoro District, Boyolali Regency - Central Java

#### c. Oil and Gas Seepage

At the location there are two seepage of oil and gas seepage 8 location.



Figure 16. Oil seepage in kerek Formation, the Repaking Village, Wonosegoro District, Boyolali Regency - Central Java.



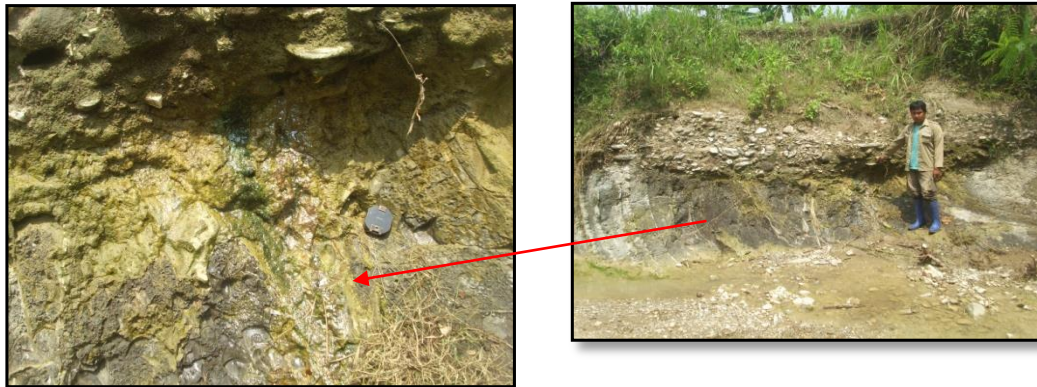


Figure 17. Oil seepage in kerek Formation, Panimbo village, Wonosegoro District, Boyolali Regency - Central Java



Figure 18. Gas is mixed with water seepage in kerek Formation, Bendungan Village, Wonosegoro District, Boyolali Regency - Central Java



Figure 19. Gas is mixed with water seepage in kerek Formation, Muning Village, Wonosegoro District, Boyolali Regency - Central Java





Figure 20. Gas is mixed with water seepage in kerek Formation, Padasmalang Village, Wonosegoro District, Boyolali Regency - Central Java.

### Positive Geological Potential

#### 1. Tourism



Figure 21. Waterfall with a height of  $\pm 18.5$  meters which is the contact boundary Kerek formation and Banyak members of the Kalibeng formation, Gunungsari village, Wonosegoro District, Boyolali Regency - Central Java





Figure 22. Waterfall with a height of  $\pm 95$  meters in first and  $\pm 12$  meters on the second waterfall located at Banyak Members of the Kalibeng Formation, Tegalsari Village, Wonosegoro District, Boyolali Regency - Central Java



Figure 23. Ngrincing Cave with  $\pm 6$  meters in height Kapung Member Kalibeng Formation in the village of Gunungsari, Wonosegoro District, Boyolali Regency - Central Java

### CONCLUSION

At the Wonosegoro subdistrict, Boyolali district and Kedungjati subdistrict, Grobogan district-Central Java, Indonesia. has the potential geological interest if the review of aspects of lithology, geological structure and the geological-based tourism, among others:

1. Aspect turbidit sediment lithology found shallow and deep.
2. Aspect of sedimentary structures found *Humocky, graded bedding, slump, mega slump, ripple mark, parallel lamination, flute cast, clay pellet, convolute lamination, sand dike, wavy lamination, cross lamination, bedding, mega block, sphaerodal wheatering.*
3. Aspects of the geological structure of faults, folds and fracture presence in the area of research is still clear and very nice.
4. Aspect of current measurements found Flute Cast ancient ideal that is still an indication of ancient currents in the study area there are two opposing currents in which the ancient southern study area trending from south to north, while in the northern part of the study area has a direction from north to south.
5. There are aspects of the geological manifestations of the oil and gas seepage.
6. Aspects of tourism found many waterfalls and caves.
7. The area we are proposing as a natural laboratory and attractions